Intel Developer Update is Intel's monthly online news magazine for developers. As the official publication of developer.intel.com, it brings hardware, software, and Web developers the latest information on Intel initiatives, technologies, platforms, and products.

Cover Story

Each month, we run a cover story on the most significant industry announcement, trend, or development for the month.

Featured Articles

Delivering in-depth reports on key platforms, products and technologies, our featured articles provide a monthly source of information on issues affecting developers. Be sure to check in every month for the latest developments driving the evolution of the industry.

Contact the Editor

To make *Intel Developer Update* a better information resource, we invite you to share your thoughts on what we've published or what you'd like to see covered. Comments are always welcome.

Archives

Our archives contain two groups of previously published articles. One group contains all the articles that appeared in *Platform Solutions News*, the earlier version of *Intel Developer Update*. The articles date from September 1997 through August 1999. The other group is set up to contain *Intel Developer Update* articles dating from the inaugural September/October 1999 issue.

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Cover Story

Intel® Pentium® III Processors Break New Ground

Craig LoConti
Product Marketing Engineer
Embedded Intel Architecture Division
Intel Corporation

Overview

The Intel® Pentium® III processor, combined with the Intel® 840 chipset in dual-processor and uni-processor configurations, delivers next-generation performance and higher-bandwidth solutions for performance-intensive communications infrastructure and appliances, transaction terminals, and industrial automation applications.

Intel Pentium III Processor

The Intel Pentium III processor at 600, 700, and 733 MHz comes in a flip-chip pin grid array (FC-PGA) package that allows for small form factor, low-profile designs. This is especially important in rack-mounted environments, such as CompactPCI (CPCI), where board height is critical.

Processor features:

- Manufactured with state-of-the-art, .18µ-process technology
- Support for both 100-MHz and 133-MHz system bus speeds
- 256-KB advanced transfer cache (on-die, full-speed Level-2 [L2] cache with Error Correcting Code–ECC)
- 32-KB (16-KB instruction/16-KB data) non-blocking, Level-1 (L1) cache
- Dynamic execution microarchitecture including multiple branch prediction, data flow analysis, and speculative execution
- Streaming SIMD extensions, consisting of 70 new instructions that enable advanced imaging, 3D, streaming audio and video, and speech recognition
- Intel® MMX™ media enhancement technology
- Dual Independent Bus (DIB) architecture that increases bandwidth and performance over single-bus processors
- Memory cacheable for 64 GB of addressable memory space
- Both dual-processor and uni-processor capability
- Data integrity and reliability features such as Error Correction Code, Fault Analysis, and Recovery for system bus data
- Intel® processor serial number, designed to improve asset management, platform identification, and information management capabilities
- Fully compatible with existing Intel® Architecture-based software
- Extended life cycle support

The processor contains a synchronous, latched-bus protocol that allows a full clock cycle for signal transmission and a full clock cycle for signal interpretation and generation. This protocol simplifies interconnect timing requirements and supports 133-MHz system bus designs using conventional interconnect technology. The processor system bus operates using Assisted Gunning Transceiver Logic, or AGTL+. AGTL+ output buffers differ from GTL+ buffers with the addition of an active pMOS pull-up transistor to “assist” the pull-up resistors during the first clock of a low-to-high voltage transition.

Intel® 840 Chipset

The Intel® 840 chipset brings a new level of performance and bandwidth to Intel Pentium III processor-based solutions. It uses the new hub link architecture found in Intel’s 8xx series of chipsets, which increases the I/O bus bandwidth for better concurrency for rich multimedia applications. The Intel 840 chipset allows flexibility for dual and single FC-PGA Intel Pentium III processor configurations with 100-MHz and 133-MHz system buses. The Intel 840 chipset consists of three main components: Memory Controller Hub (MCH), I/O Controller Hub (ICH), and Firmware Hub (FWH).

Architectural expansion is provided with the memory expansion card and PCI 64-bit Hub. Up to a maximum of 4 GB of either RDRAM or SDRAM may be configured through repeater hubs. The
Memory Repeater Hub for RDRAM (MRH-R) provides memory expansion capabilities for RDRAM channels. The Memory Repeater Hub for SDRAM (MRH-S) provides the capability of supporting SDRAM. The MCH directly supports dual channels of Direct Rambus* memory operating in lockstep using Rambus* Signaling Level (RSL) technology. In addition, the MCH provides optional ECC error checking for DRAM data integrity. The PCI 64 Hub (P64H) provides PCI bridging functions between the hub interface and PCI Bus. The Intel 840 chipset components are interconnected via an interface called “hub interface.” The hub interface provides efficient communication between the chipset components.

Additional hardware platform features, supported by the Intel 840 chipset, include AGP 4X, RDRAM, Ultra DMA/66, Low Pin Count interface (LPC), and Universal Serial Bus (USB). The Intel 840 chipset architecture removes the requirement for the ISA expansion bus that was traditionally integrated into the I/O subsystem of PCIsets/AGPsets. This approach eliminates many of the conflicts experienced when installing legacy ISA hardware and drivers.

The Intel 840 chipset architecture enables a new security and manageability infrastructure through the Firmware Hub component. A custom set of features provides a consistent pre-boot environment and enables a protected infrastructure for the storage and update of platform code and data. The Intel 840 chipset is also ACPI compliant and supports Full-on, Stop Grant, Suspend to RAM, Suspend to Disk, and Soft-off power management states. Through the use of an appropriate LAN device, the Intel 840 chipset also supports Wake-on-LAN* for remote administration and troubleshooting.

Intel® 840 Chipset Block Diagram

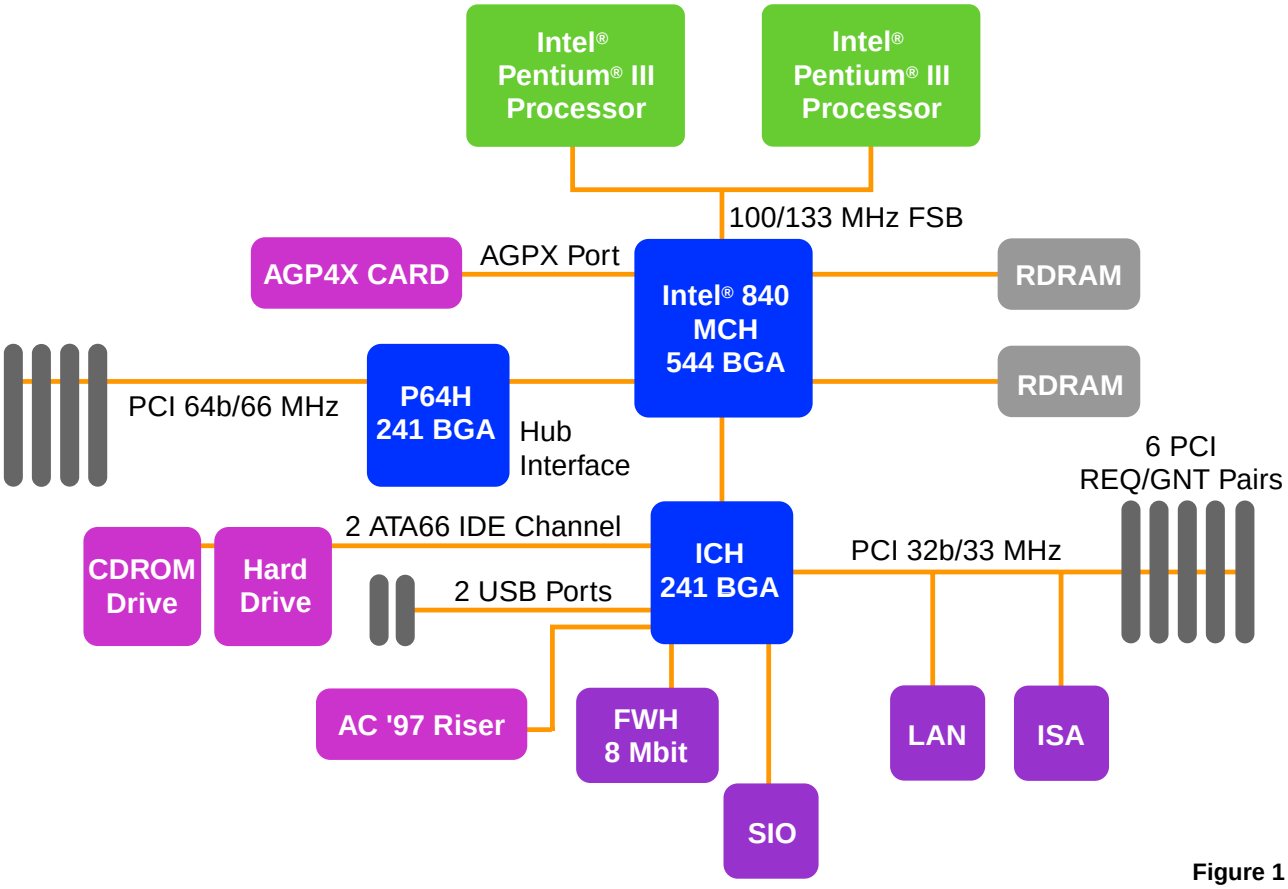

Figure 1

Design Support

A variety of design support is available for the Intel Pentium III processor and Intel 840 Chipset.

- The Intel Pentium III processor/840 Chipset Development Kit expedites the design of high-performance, dedicated-use applications.
- The Intel® Applied Computing System Firmware (ACSF) Library v1.1 simplifies the creation of initialization software for applied computing platforms based on 32-bit Intel Architecture. Intel Applied Computing System Firmware Library, with Intel Pentium III processor support, is available for download from the Intel Developer Web site.
- Board-level solutions featuring the new Intel Pentium III processor and Intel 840 chipset are available in a number of form factors: CPCI, PCI/ISA, and ATX. These products are provided through the Intel® Applied Computing Platform Providers.

These building blocks help get products to market quickly and efficiently.

Other Chipsets

The Intel Pentium III processor (FC-PGA) is validated with multiple chipsets for maximum flexibility. Combined with either the Intel® 810 or 440BX® chipset, you can design one board that can be populated with either the Intel Celeron™ or Intel Pentium III processor family at build time, without requiring board changes. This provides price and performance options, lower total cost of ownership and faster time-to-market.

Summary

The Intel Pentium III processor is validated with multiple chipsets for maximum flexibility and scalability. Combined with the Intel 840 chipset, the Intel Pentium III processor provides high performance and bandwidth, including support for a 133-MHz system bus, dual processing, and a second PCI bus. The Intel Pentium III processor-based hardware and software building blocks plus design support help speed the design process and lower total development costs.

More Info

For more technical information on the Intel Pentium III processor and Intel 840 chipset, design support such as development kits, Intel ACSF Library, and board-level solutions from our Applied Computing Platform Providers, visit the Intel Developer Web site:

- Intel Pentium III processor
- Intel Pentium III processor Documentation
- Intel 840 Chipset Information
- Intel 840 Chipset Documentation
- Intel 840 Chipset Web Demo
- Intel Pentium III processor/840 Chipset Development Kit
- Intel ACSF Library
- Applied Computing Platform Providers

For more detailed AGP interface functionality, visit the AGP Implementors Forum Web site.

Author Bio

Craig LoConti recently joined Intel's Embedded Intel Architecture Division as a product marketing engineer. He has product management responsibilities for Intel Pentium III processors and the Intel 840 chipset. Craig comes to Intel with four years' experience as an engineer with GE Aircraft Engines, where he was awarded a patent. Previously, Craig worked for more than four years with a CAD/CAM software company, where he managed hardware and software marketing programs with computer OEMs. Craig holds a B.S.A.E. degree from Virginia Tech and an M.B.A. from the University of Cincinnati.

Columns

From the Editor

Donna Loveland
Managing Editor
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Column

It may be June, when much of the world starts thinking about holidays and vacations. Even so, Intel developers are hard at work, creating the products and technologies and tools you need to carry out your own designs. This month's issue is loaded with great information and advice.

Intel® Pentium® III Processors Break New Ground, this month's cover story, explains how the Intel Pentium III processor, combined with the Intel® 840 chipset in dual-processor and uni-processor configurations, delivers next-generation performance, higher-bandwidth solutions for performance-intensive applications.

Communications Reference Design in Action tackles the convergence of voice and data, and the need for minimizing time-to-market and development cost for infrastructure and appliances. This article explains the implementation of two increasingly needed applications: Web caching and Virtual Private Network (VPN)/firewall.

Intel® Desktop Board D810EMO Meets Ease of Use gives a tour of Intel's new FlexATX form factor board. It uses key features and technologies in the recently released Intel® 810E chipset to support Ease of Use in a small form factor while giving system integrators the ability to customize processing requirements.

DTV Tools for Content Creation and Delivery outlines the feature sets developers need to address as they design content creation and delivery tools for Web and broadcast professionals. With Web and broadcast technologies converging, developers can create tools that help make creation and delivery a seamless process.

HomeRF*-SWAP: Optimized for Home Networking details the advantages of the Shared Wireless Access Protocol specification, the optimal solution for developers of untethered consumer devices that require an Internet connection. Designed to support versatile voice and data communications, it combines low cost, ease of installation, and operational transparency.

Intel® IA-64 Porting Center describes a new online resource for developers of high-end applications. To ensure that products are ready when the Intel® Itanium™ processor is released, Intel and other companies are making operating systems information, software-development tools, and other vital material available to address multiple-platform issues and ease porting.

Design Tools from the PC Ease of Use Roundtable presents the many white papers and user assessment tools PC development teams can use to create products with a greater probability of customer satisfaction. The article also talks about current and future directions for this active industry group.

Take a vacation from your search for the latest on Intel developments. Just turn to the pages of June's *Intel Developer Update* magazine.

Enjoy.

Author Bio

Donna Loveland is the editor of *Intel Developer Update* magazine. She joined Intel's Platform Marketing group in 1999 as the editor of Platform Solutions News. Donna began her career with Intel in 1982 as a technical editor in an advanced microprocessor development group. Since then, she's held technical and marketing positions in leading-edge technology areas ranging from stereoscopic display to digital broadcast to scalable online content. Donna has a B.A. degree in English from the University of Rochester and an M.A. in Expository Writing from the University of Iowa.

Inside Looking In

Column
Inside Looking In will return next month.

Departments

Applied Computing

Communications Reference Design in Action

Shahidat Abbas
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Overview

The convergence of voice and data in the data/telecom market segment provides for growing technology demands. Embedded Intel® Architecture is becoming an increasingly valued piece of this growth. A variety of products provide solutions that minimize time-to-market and lower total cost for both communications infrastructure and appliances. Communications appliances are segmented into five categories: appliances that deliver storage, security, management, voice, and integrated services to the network. The recently announced Entry-Level Communications Appliance Reference Design from Intel has been a key piece of this value.

This article explains the implementation of two increasingly needed applications: Web caching and Virtual Private Network (VPN)/firewall. This article encapsulates the related presentation and demonstration given in the Applied Computing track at the Intel Developer Forum (IDF) Spring 2000 Conference.

Reference Design

The Entry-Level Communications Appliance Reference Design appliance was a conceptual development intended for a variety of specialized functions utilized in the communications market segment. This design contains the essential components for delivering the right performance and functionality for entry-level communications appliances. Appliances that fit this category are network attached storage, Web caching, load balancing, firewall, VPN, and e-Commerce services that help deliver a new level of services to the network. The flexibility, scalability, and reliability of Intel Architecture in combination with this reference design, lets developers reduce time-to-market by delivering a complete design that is easily modified without re-working the core microprocessor and chipset design.

At the IDF Spring 2000 Conference, the Entry-Level Communications Appliance Reference Design was utilized to demonstrate both a bandwidth manager and a security appliance. In particular, a board based on the reference design, running the open source Linux* operating system (OS), displayed Web caching and VPN/firewall capabilities.

Web Caching

Web caching may not seem immediately necessary. However, the World Wide Web is by far the largest network currently in existence. Users around the globe “hook up” to the network and constantly access information. The increased number of users utilizing the network decreases the available bandwidth while increasing the wait time for requested data.

Web caching is a methodology whereby frequently requested Web content is stored, or “cached,” locally, thus reducing the amount of time it takes the user to retrieve the data. In a small business environment, a multi-function platform such as the Entry-Level Communication Reference Design may act as the local Web-caching server, storing the most frequently requested pages for the office. Instead of pulling the information from the origin Web server, the information is pulled from the local cache in a much more timely fashion thus reducing the bandwidth requirements to the wide area network.

For the IDF demo, the reference design platform was set up to emulate a small business environment. The reference design consists of two Ethernet connections. Eth0 was the connection to the Internet, and Eth1 was the connection to the company intranet. The intranet consists of multiple clients, all with varying needs to access the Web.

The Web caching software used for the demo is called Squid*. Squid is an open source Linux Web-caching solution. Using Squid, the communication appliance was configured as a transparent proxy machine. Additionally, the Squid configuration file and the system ipchain rules were set up to allow all Web accesses from the clients to be "hijacked" by the proxy and presented by the proxy to the Web. Once the Web cache was initialized, the proxy, via the Web cache, serviced all client requests for Web content.

To measure the benefits realized with Web caching, we used a Web-caching performance measurement tool, CacheFlow*'s Cache Performance Testing Tool. The software is actually run on the client machines and its set up constantly requests Web pages for a given period of time. The average request time per page, and per object in the pages, is then calculated. This measurement is done with and without the Web cache in place and the results compared. A marked improvement in response time using Web caching versus no Web caching was demonstrated with this arrangement.

VPN/Firewall

The second feature demonstrated on the Entry-Level Communications Appliance Reference Design was virtual private networking and firewall functionality. For this portion of the demo we used Check Point Corporation's VPN-1/FW-1* software for Linux. Virtual private networking is a security feature that provides for a private, secure communication channel via a public, unsecured medium. In this case, the public medium was the Internet, and our private channel was a VPN tunnel from one network to a second network. For this demo example, the board based on the reference design is the security appliance that administers a VPN tunnel.

The VPN tunnel is established between two networks, A and B. Network A is encryption domain A, and network B is encryption domain B. Network A consists of a Linux machine acting as a gateway to a network with multiple clients. Network B is the exact same setup as network A. The only difference between the two setups is that the Linux gateway machine in network A is our Entry-Level Communications Appliance Reference Design running the administration portion of the Check Point software.

Each of the gateway machines is configured as a transparent proxy, and the clients behind the gateway machines are given non-routable IP addresses. Normally, the clients should not be able to communicate with each other across the two networks because of the non-routable IP addresses; however, the existence of a VPN tunnel between the two networks allows communication and also provides that communication on a secure channel.

Using the GUI management software portion of the VPN-1/FW-1 package, firewall rules that dictate the parameters of our VPN tunnel are established. The demo illustrated that the two encryption domains can indeed communicate with each other and that the communication is secure. The log viewer feature of the Check Point software further monitors the encryption and decryption of the messages sent via the two networks. This is just one example of how the Check Point software may be configured for a VPN application.

Summary

With increasing demands for new technology in the data/telecom market segment, developers need to get high-performance applications and services to market quickly. The Entry-Level Communications Appliance Reference Design in coordination with embedded Intel Architecture's flexibility and scalability provide developers a valuable tool to meet these needs.

More Info

For more technical information on the Entry-Level Communications Appliance Reference Design and Embedded Intel Architecture in Communications, visit the Communications Applied Computing Platforms area of the Intel Developer Web site.

For more information on some of the software and tools utilized in the IDF demonstration, visit these vendors' sites:

- Squid Web Proxy Cache
- Check Point Corporation
- CacheFlow Cache Performance Testing Tool

Author Bio

Shahidat Abbas is a software technical marketing engineer currently working on applied computing enabling products for Intel's Embedded Intel Architecture Division. In 1993, Shahidat joined Intel via the engineering intern and graduate rotation programs, which cover a wide range of engineering disciplines. Her focus from 1997 through 1999 was software systems engineering for the I/O Processor Division. Shahidat holds a B.S.E.E. from Rensselaer Polytechnic Institute.

Desktop

Intel® Desktop Board D810EMO Meets Ease of Use

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Overview

In today's market, technology is evolving at a higher rate than ever before, particularly in small form factor solutions. For system developers, the competitive challenge lies in meeting industry-standard ease of use requirements by providing simpler, smaller system designs.

The new Intel® Desktop Board D810EMO utilizes key features and technologies in the recently released Intel® 810E chipset to provide a critical building block in the Ease of Use PC Initiative. Based on the new FlexATX form factor, the Intel Desktop Board D810EMO offers a legacy-reduced solution ideal for small form factor PC designs. By supporting the full line of Intel® Pentium® III and Celeron™ processors, this new board allows system integrators to customize processing requirements based on customer needs.

Direct USB Connectivity

In place of legacy connectors, the Desktop Board D810EMO offers four USB ports for peripheral device connectivity: two out the back and two out the front of the chassis. This USB implementation delivers faster data transfer rates than serial and parallel ports and improves system compatibility. USB devices are also "hot swappable" so that once a system is powered up, peripheral devices can be connected and accessed without having to reboot.

This results in time savings and better peripheral compatibility because the O/S will recognize the device without having to load specific drivers. The D810EMO product available in the indirect distribution channel will include an appropriately configured back panel I/O shield and a dual stack USB daughtercard (with shielded cable) to support the front panel connectivity. While the Desktop Board D810EMO focuses on USB connectivity for external devices, a single PCI slot is also included, primarily for modem integration.

Instant Awake Features

With the increased reliance on PCs in both business and domestic environments, users need the ability to gain access to their systems quickly. With Instantly Available PC (IAPC), systems suspend operation and go into a low-power state (suspend to RAM). When the user comes back to the PC after a period of time, the system can be instantly accessed by touching the mouse or keyboard or by pressing the power button. The system will then resume operation within 3 to 5 seconds, returning to whatever application or "state" used last.

OEMs have traditionally led the way with innovative PC development through proprietary designs and key supplier relationships. With the Desktop Board D810EMO, Intel is delivering a critical building block for small form factor PC designs to smaller system integrators, increasing their competitive capabilities.

Enhanced System Performance

The D810EMO is based on the Intel 810E chipset and features a 370-pin PGA socket connector. The Intel 810E chipset introduced a number of new performance-enhancing features:

- Integrated Intel® 3D Graphics featuring Intel® Dynamic Video Memory Technology and further enhanced with 4 MB of Display Cache
- 133 MHz/100 MHz/66 MHz System Bus support
- Ultra ATA/66 support for faster data access
- Instantly Available PC (Suspend to RAM)

In addition to versatile processor support and performance technologies, the platform also features Creative Labs* PCI 128V audio subsystem and the Intel® 82559 LAN controller, which is capable of delivering 10/100-Mb network connectivity.

Reliable Solutions

The trend is clearly toward smaller overall system designs, smaller boards, greater feature integration, enhanced performance, and Ease of Use. As desktop boards continue to decrease in size, Intel's goal is to provide building block solutions system integrators can rely on, at a production rate to support faster time-to-market.

Intel desktop board products are backed by a three-year limited warranty.

Summary

The Intel Desktop Board D810EMO embodies the advanced technologies and features that allow for legacy-free, small form factor PC designs. Direct USB connectivity delivers a board that meets Ease of Use guidelines. By adhering to the new FlexATX form factor, this desktop board lets system builders break out of the beige box mold and increase their competitive position within the industry.

More Info

For more information, please visit the Intel Developer Web site and the Ease of Use Initiative Web site.

Author Bio

W. Alan Yost is a product marketing engineer with the Desktop Board Team in Intel's Reseller Products Division (RPD). During his five years at Intel, Alan has worked in sales and marketing, with a focus on board product marketing since 1997. During this time he has successfully launched six board products into the RPD channel. A graduate of Lewis and Clark College in Portland, Oregon, Alan majored in history and fine arts, earning honors in history.

Design Tools from the PC Ease of Use Roundtable

Paul F. Sorenson
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Overview

In 1998, PCs were in use by 40 to 45 percent of the US homes, and Intel and PC OEMs were very interested in growing this market further. Research by Intel and others had shown the second most cited reason for not buying a PC was that it was “too difficult” or “too complicated.” PC products generated high call volumes on customer support lines. Some 40 to 50 percent of products sold caused calls, average call time was 15 minutes, and average costs per PC ranged from $40 to $150. When PC products were returned because “it doesn’t work right,” up to 75 percent of cases were classed as “no defect found”—vendors assumed the issues driving the return were the results of poor usability. Cost to the industry was significant (up to $200 per returned PC), and the rates of both calls and returns were about 10 times as frequent as for other consumer electronics products.

The PC Ease of Use Roundtable was started in August of 1998 as an informal, cross-industry body who could work together to improve PC ease of use. The Roundtable adopted this objective: “To identify and drive awareness of the ease of use of consumer PCs through defining desired user experiences for key tasks and the opportunities to improve it.”

Since then, the Roundtable has met monthly, growing its participants to include PC OEMs, communications, networking, and peripheral providers. Participants include Intel Corporation, 3Com Corporation, Altec Lansing Technologies, Inc., America Online, Inc., Aveo, Inc., Canon, Inc., Cisco Systems, Compaq Computer Corporation, Creative Technology, Ltd., Dell Computer Corporation, Gateway, Inc., Hewlett-Packard Company, NEC Corporation, IBM Corporation, InFocus Systems, Inc., Iomega Corp., Eastman Kodak Company, Lexmark International, Inc., Logitech, Lucent Technologies, Virtual Networks, Nortel Networks, and Samsung Electronics Corporation. The PC Ease of Use Roundtable has delivered a series of white papers and tools that can be used to focus development efforts on improving ease of use in three key areas: PCs, Communications, and Networking.

This article has a threefold purpose:

1) To introduce and describe the work of the PC Ease of Use Roundtable, one of several efforts Intel is leading as part of a multi-year focus on improving PC ease of use.
2) To summarize the deliverables from the roundtable thus far, and show how each white paper and tool can be used to focus design and development efforts to improve product usability.
3) To encourage developers to pay continued attention to the Roundtable’s direction and efforts in the future, taking advantage of its work to make PCs intuitive and simple to learn and use.

How It Works

For each topic the Roundtable considers, participants follow a rigorous analysis process that has been refined over the past two years (see Figure 1). It begins with consideration of user data from several sources, provided by the participating companies and shared in the open environment of the forum in order to keep the deliverables and focus of the group data-driven. These data include customer calls, return rates and root-cause analyses, usability tests, and requirements or other customer attitude data.

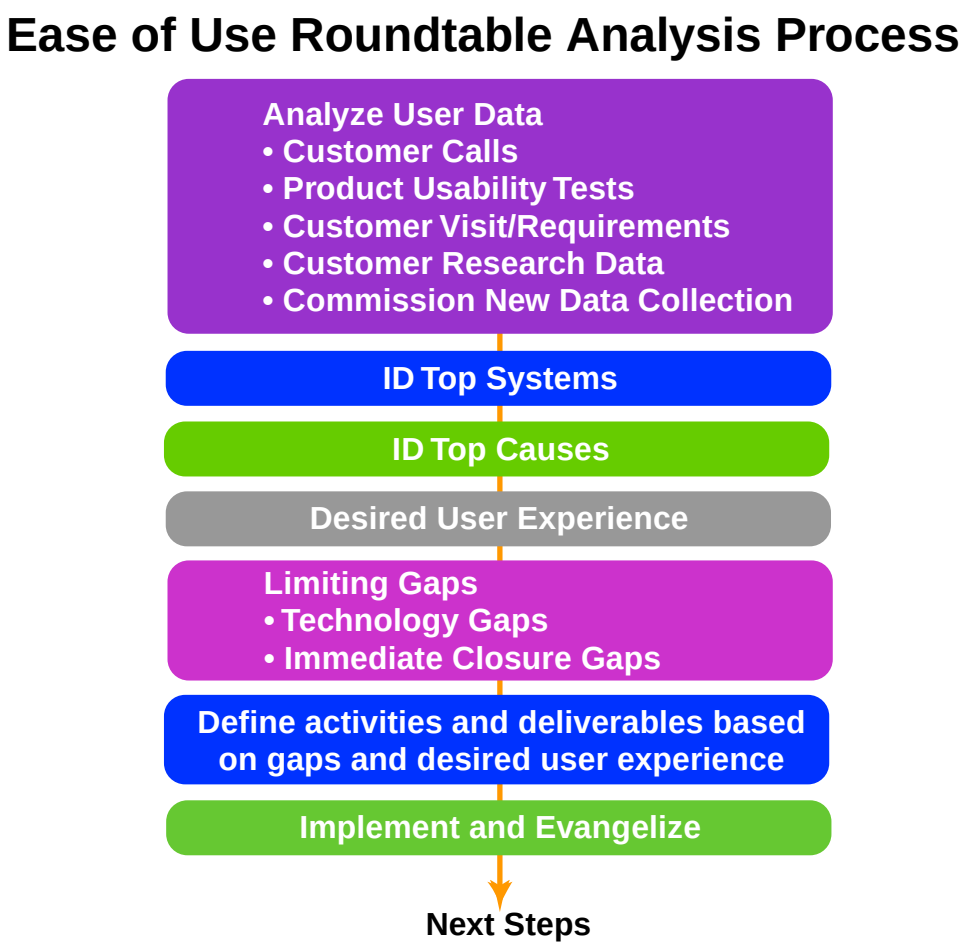

Figure 1

After the data from all these sources is collated and understood, symptoms are created that describe, from the users' points of view, unique problems or issues. For each symptom, one or more causes are determined—often through Roundtable members returning to their engineers and researching between meetings—and carefully worded. For each problem or symptom, the Desired User Experience (DUE) is then crafted.

This DUE is defined as the ideal experience for the task or feature in question from the users' points of view: no consideration of feasibility or implementation difficulty should taint this part of the analysis. The goal here is to put a stake in the ground defining an ideal usability experience.

Finally, the group considers gaps between the current state of affairs (the symptom/causes) and the DUE, and works up a set of near- and long-term opportunities for the industry to pursue in narrowing, or closing, the gaps.

In some cases, the opportunities listed will be pursued by individual companies in private, each seeking whatever differentiation and/or competitive advantage they can, given the nature of their solution. In other cases, the Roundtable will recognize that the opportunity can and should be pursued by the group as a whole (for example, developing a set of guidelines or tools—see IEP Tool section). Finally, it is often the case that subsets or participating companies who recognize mutual self-interest and synergy in addressing one or more of the opportunities will get together outside the Roundtable and pursue solutions together.

White Papers

In every case thus far, the first deliverable from Roundtable work has been a white paper describing the results of the work just summarized. These white papers are posted on a public Ease of Use Roundtable Web site, and they contain the key ease of use problem areas for focus by the industry, namely PC, Communications, and Networking.

By prioritizing the many issues on the basis of cost impact to the industry, these papers let companies focus their engineering and creativity on the "big hitter" issues first. The goal is reducing post-sale sources of cost and churn, improving word-of-mouth, and creating a more positive image for PC products in the marketplace.

This section briefly describes each white paper the Roundtable has produced thus far, and considers examples of the key problem areas, desired user experiences, and opportunities for solutions. Interested readers can download each of the published white papers from the Roundtable Web site.

As an example of the content available in these white papers, consider this excerpt. It details desired user experiences and opportunities for both near- and long-term industry actions.

Users should be able to connect to the Internet effortlessly. We need to provide an experience where first time Internet access from a PC is as easy as plugging in and using a new phone.

- First-time setup should be simple and easy. The user should have to provide only the absolute minimum information, and information should only be requested once and then stored, with adequate security control, for all other applications to use. Information should be requested in user friendly language (for example, "Do you want multiple email addresses?"). Users should not have to provide technical information.
- Hardware setup should be foolproof. For example, if a modem has multiple ports, it should be impossible to make a wrong connection. Connection hardware should also work "out of the box," the first time the user tries to connect to an ISP.
- During changes and upgrades, all relevant configuration information should be saved and reused without the user having to provide it again. For example, address book data and modem settings should be automatically transported as part of the change.
- The system should self-diagnose connection problems, and if possible, also self-correct. If user involvement is required, options should be presented in terms the user understands.

Examples of immediate opportunities for the industry

In the short term, making the following implementation-level changes can make Internet communications easier:

- Develop solutions where users only have to enter pertinent information one time, and that include adequate privacy and security features.
- Pre-configure user information at PC build time or at point of purchase to take that burden off the consumer.
- Help users select unique and meaningful user names, which they can use for all communication services. Also provide users with a quick and secure way to reset their ISP passwords.
- Make sure users do not have to reconfigure settings when standard phone/cable/service provider options change. For example, users should not have to reconfigure their systems to handle dialing protocol changes such as 10-digit dialing in the USA or call forwarding….

Examples of longer-term opportunities for the industry

In the long-term, we recommend addressing the following technology gaps:

- Improve interoperability between the PC and telecommunication equipment to automatically optimize for phone service features. For example, call waiting or 10-digit dialing.
- Create diagnostics of the whole consumer communication chain that can detect the exact cause of the failure. This can include monitors of connection progress and on-going connection quality. Auto-correction with logging for support personnel is ideal. If user interaction is required, messages should be in terms the user understands.
- Develop an ISP/OS handshake architecture so the ISP and OS can exchange configuration information and solve connection problems without involving the user. Make sure the architecture protects user privacy and provides security.
- Work toward making communications data transportable among different PCs. For example, the user should be able to effortlessly move address books or ISP account information from one PC to another.

Metrics

- A significant decrease in user calls per PC requesting help to connect to the Internet.
- Usability tests showing improved ease of use for novice users connecting to the Internet.

Consumer Desktop

This initial white paper was published in 1999, and it has been updated once to track improvements in the eight problem areas identified for consumer desktop PCs (as of February 2000, PC OEMs rated over 50 percent of these problem areas "significantly improved" based on call and return data). Table 1 lists the ease of use dissatisfaction areas.

Table 1. Ease of Use Dissatisfaction

Area of Dissatisfaction	Main Cause of Dissatisfaction
(1) Boot/Reboot	Users perceive they have to reboot too frequently and booting takes too long.
(2) Communications	Users have trouble accessing and using the Internet (modems, mail, Web sites).
(3) Environment	Users perceive PC performance and reliability can degrade over time.
(4) Failure Detection	Users perceive hardware and software fail too often, and failures are difficult to diagnose.
(5) Install/Uninstall	Users often feel it is difficult to install and uninstall hardware and software.
(6) Interoperability/Compatibility	As users add applications and hardware, applications and hardware sometimes do not work well together.
(7) OOBE (Out Of Box Experience)	Many users are dissatisfied with how long it takes, and how difficult it is, to set up and use the PC the first time.
(8) User Task Assistance	Users cannot always determine how to do what they want to do on the computer.

Several Roundtable follow-on efforts resulted directly from this analysis, and opportunities for improvement were identified. For example, a tool that predicts novice user performance in setting up, configuring, and beginning to use a PC (the Initial Experience Predictor Tool) was developed as a direct result of the OOBE item. Another guideline, focused on addressing some of the symptoms under failure detection and user assistance, came to be the Design for Supportability Tool. In addition to these Roundtable-wide efforts, a spin-off analysis focused on the Communications area gave rise to a separate white paper and brought Lucent Technologies, 3Com Corporation, Cisco Systems, Nortel Networks, America Online, Inc., and others to participate in the Roundtable.

Finally, most of the original PC OEM participants in the Roundtable have focused extensive efforts on these areas internally, as attested to by the improvements reported in the Roundtable's yearly comparisons and the emergence of what are being called "ease of use SKUs" in the PC marketplace.

Communications

The Roundtable quickly determined that its current participants didn't have enough direct expertise to adequately address the issues they were finding in the Communications area, so it recruited new participants (Lucent Technologies, America Online, Inc., Diamond Technologies, and others) and initiated a separate effort designed to focus on these issues. Accordingly, it published the Internet Communications white paper in December 1999.

In this document, the importance of the Internet and interacting with the World Wide Web via PC were detailed, and the Internet was identified as a driving factor in PC growth for these reasons:

- People are increasingly depending on Internet access as a primary means of communication, resource management, enrichment, multimedia-intensive interactions, and social activities.
- People are accessing the Internet mainly from the home, work, and university environments, with a very strong movement toward Internet access from mobile environments as well.
- Internet users are becoming more diverse, with a dramatic widening of ages, incomes, both genders, and kinds and levels of education.
- Growth of Internet connection in the home is rapid. As of mid-1998, 44 percent of households owned a PC and 55 percent of those households were online (Online Nation: 1998 U.S. Internet User Survey). In August 1999, Bill Gates stated at the Dell DirectConnect* Conference that 50 percent of households had PCs, and 90 percent of those were connected to the Internet.

The need for easier PC Internet setup, faster access speeds, greater network reliability, and simpler user interfaces for common Internet tasks have become critically important to Internet users. For example, network reliability and quality of service, which are currently competitive differentiators, are quickly becoming a baseline expectation for people using the Internet.
The Roundtable found these to be the most important focus items for ease of use improvement efforts:

- Getting connected the first time can be complex for a new PC user. This category includes all the necessary software and hardware setup, including situations where the PC is upgraded or the service provider changed.
- Ongoing connection quality does not meet some users' expectations. This includes perceived slow speed, fail-to-connect or dropped-connection problems, and problems caused by telephone features like call waiting or changes to dialing protocols (for example, 10-digit dialing in the United States).

New users need help learning the common Internet tasks. Browsing the Web, downloading files, and using e-mail are examples. This need is measured by call center questions on how to attach files or read attachments in e-mail, how to handle plug-ins or pop-ups, how to download files, how to find downloaded files, and similar questions. (See the PDF excerpt in White Papers detailing the Desired User Experiences and opportunities for both near- and long-term industry actions.) You can find the entire Internet Communications White Paper on the Ease of Use Roundtable Web site (57 K).

Small Biz/Home Networking

This white paper is under development. Roundtable members with networking businesses (Intel Corporation, 3Com Corporation, Cisco Systems, Nortel Networks, IBM Corporation, Hewlett-Packard Company, Gateway, Inc., Dell Computer Corporation, and Compaq Computer Corporation) are contributing to the content and data. The planned publication date is late June to mid-July 2000. As with the other Roundtable white papers, this document will lead to further action by the Roundtable as a whole, by small groups of Roundtable participants, and by individual companies on their own. In contrast to the other white papers, however, the networking document will also provide design guidance for configurations–networks that feature fused media (voice/data along with video, pictures, and audio) transmission within and to/from the network over "big pipe" linkage to the Internet, for example.

This white paper addresses each of the networking ease-of-use improvement areas in turn. For each problem area, it lists specific areas of user dissatisfaction and the causes for dissatisfaction. It describes the desired user experience and identifies opportunities for improvement in the short and long term. In addition, it provides metrics for measuring improvement in each of these areas.

IEP Tool

The Initial Experience Prediction (IEP) Tool is a checklist for evaluating the "Out Of Box Experience" (OOBE) of setting up a new PC purchased through the retail channel. Each item in this checklist pertains to a characteristic or quality of a PC system that influences how effective a novice user will be in unpacking, assembling, powering on, and configuring software on a PC. IEP is intended to help a computer industry professional predict a novice end user's experience with consumer desktop PCs.

For teams who lack the resources to perform usability tests, IEP provides a method to predict how well novices will fare with their systems. The IEP's power lies in the explicit prediction of novice user performance in a controlled setting, with a scoring system that can be administered and analyzed quickly. The Initial Experience Prediction Tool can be found in the IEP area of the Ease of Use Roundtable Web site.

Design for Supportability

Roundtable members developed this tool to let OEMs focus design on PC improvements, reduce support calls, drive down support costs, and provide linkage to design through IEP tie-ins. Specifically, this effort was spawned from Consumer Desktop problem areas 4 (failure detection), 6 (compatibility), and 8 (user task assistance). The guideline tool was designed to be efficient, easy-to-use by design teams, usable as a design guideline tied to the IEP categories, replicable (OEMs get consistent results), and easy to interpret and score.

The Roundtable reasoned that guidelines for considering a range of possible support solutions for typical (or likely) ease of use problems might prove useful, especially if the tool could capture the tradeoff between support solutions optimal for end users and those optimal for the company providing the product in question. Roundtable work in this area showed clearly that these two perspectives, or goals, often lead to very different support solutions. For example, in many cases, a call center solution works quite well for end users, but the costs of such solutions are prohibitive in most cases (see Overview). Design for Supportability Guidelines is an Excel* application that may be downloaded from the Ease of Use Roundtable Web site (125 K).

Future Issues

The Roundtable anticipates continuing to hold twice-yearly data shares for each of the white paper areas of concern (PCs, Communications, and Networking). Each data share will result in updates to these documents in which progress is tracked and presented.

In addition, the Roundtable is beginning work on ease of use problems with peripherals (e.g., printers, scanners, cameras, toys, PDAs, and smart phones), and it expects to take on new areas and technologies that promise to become important parts of the computing experience in the future. These topic areas could include broadband communications, multimedia and wireless networking, power management, and online support systems.

Intel encourages the development community to check the PC Ease of Use Roundtable Web site regularly for information and additional tools focused on improving ease of use in computing with PCs.

Summary

The PC Ease of Use Roundtable, an informal industry body, has been working since 1998 to make PC use more enjoyable for consumers and less costly for vendors. In pursuing its charter to identify and drive ease of use, the Roundtable has created a number of opportunities for developers to improve PC products. The findings and recommendations documented in its numerous white papers and tools have already come to market in products that make PCs easier to use. The Roundtable makes its materials available to the developers free of charges and fees, and it encourages broader industry participation in its ongoing efforts.

More Info

Tools and white papers as well as information about the Ease of Use Roundtable itself is available from the Ease of Use Roundtable Web site. You can also check the Developer Web site Ease of Use area.

See and hear about the latest in EOU Roundtable efforts at the Fall ’00 Intel Developer Forum Conference, August 22 through 24 in San Jose, California. For questions and comments on the Ease of Use Roundtable go to info@eouroundtable.com.

For questions and comments on the Ease of Use Roundtable, send e-mail to the site’s inbox at info@eouroundtable.com.

Author Bio

Paul Sorenson manages Intel's User Centered Design Group, an internal consulting team focused on understanding how end users interact with technology. He began his career at Intel in 1994 with the company's PC Enhancement Operation, which marketed Intel's first consumer products.

Paul has been a core team member on the PC Ease of Use Roundtable since its inception. He leads Roundtable efforts on the Design for Supportability Guidelines and the Initial Experience Predictor Tool now in use by Intel and many PC OEMs.

Before joining Intel, Paul spent more than a decade at IBM Corp., Lockheed Martin Corp., and the Hewlett-Packard Co. working on a wide range of products, including the first PC mice, advanced user interface prototyping systems, and the first palm-top PCs.

Paul holds a B.S. degree in biology from Willamette University and a master’s degree in Neurophysiology/Linguistic-semantics/Experimental Psychology from the University of Oregon. His doctoral work was with the University of Texas, Austin, is in Human Experimental Psychology.

Initiatives and Technologies

HomeRF*-SWAP: Optimized for Home Networking

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Overview

The SWAP (Shared Wireless Access Protocol) specification, defined by the HomeRF* Working Group, is the optimal solution for developers of untethered consumer devices that require an Internet connection. It also provides the advantage of voice support and interoperability with public switched telephone networks.

Cordless telephony is the number-one wireless application in the home today. And with broadband arriving, SWAP-based HomeRF network gateways extend the usage model to provide multi-user Internet connectivity throughout the home.

The electronics press has recently reported on the rival technologies currently competing for acceptance in the home wireless networking space. While each has particular strengths, only one of them, HomeRF wireless networking, based on the SWAP specification, was designed from scratch to support versatile voice and data communications. It combines low cost, ease of installation, and operational transparency required by home users.

This unique mix of capabilities and functionality is unequalled by other wireless technologies, a fact that accounts for the recent wave of SWAP-enabled HomeRF wireless networking products arriving on the market.

"Two-Hand" Rule

Several radio technologies that use the 2.4-GHz band, including Bluetooth*, wireless Ethernet, and SWAP, are currently contending for industry and consumer recognition as the pre-eminent method for wireless home networking. In comparing these technologies, it is useful to apply the "two-hand" rule.

Portable devices that can be held in just one hand, such as PDAs (Personal Data Assistants), usually do not need to be connected to more than one other device at a time. The Bluetooth wireless specification was designed for this usage model.

In Europe, where it is not legal to hold a cell phone while driving, Bluetooth was created to fill the need for a short-range connectivity standard for wireless cellular headsets. With its 10-meter range, the number of devices that can be connected at one time is limited to seven, and Bluetooth does not need to be a spectrally efficient specification. Bluetooth is ideal in a "cable replacement" or "personal area network" (PAN) usage model, used to synchronize data between a PC or other device and a one-handed device.

By comparison, SWAP is optimized to enable "two-handed" portable devices such as laptops, and a new class of devices where it makes sense to add network support for Internet connectivity and high-quality, longer range voice telephony support. These applications include cordless data pads with telephone functionality in addition to cordless phones that currently support multiple handsets and will support Internet and data capability. SWAP also provides a low-cost, reliable, and easy-to-install way to network multiple PCs in order to share a broadband Internet connection. It has other wireless networking advantages as well, such as data transfer, peripheral and file sharing, multi-player gaming, and home control and security features.

What About 802.11b?

Momentum is building in the wireless home networking arena. One indicator of this trend is the migration of other wireless networking standards into the home. A good example is the 802.11b wireless Ethernet specification.

The 802.11b was originally designed to enable high-performance radio to support roaming in a large office or business campus environment. While it can support Voice-over-Internet Protocol (VoIP) capability, it is relatively expensive compared to SWAP. In addition, wireless Ethernet depends on a distributed contention-based algorithm, which induces

latency in voice transmissions. This limitation does not exist with SWAP. Moreover, true telephony requires more than just voice support. It also must have a sideband capability for flash hook, caller ID, and many other functions. Unlike wireless Ethernet, the SWAP specification defines the full range of telephony functionality based on the DECT (Digital Enhanced Cordless Telephony) standard.

HomeRF Technologies

SWAP combines the efficiency of CSMA/CA (Carrier Sense Multiple Access/Collision Avoidance), a contention-based packet protocol for data, with TDMA (Time Division Multiple Access), a contention-free connection protocol for voice services.

SWAP is designed to interoperate with Public Switched Telephone Network (PSTN) services and with the Internet in the 2,400-MHz ISM (Industrial/Scientific/Medical) band using frequency-hopping spread-spectrum radio. The frequency-hopping network runs at 50 hops/second with a transmission power of 100 mW and a 50-meter range, sufficient to cover the typical home, garage, and yard.

SWAP supports a data rate of up to 1.6 Mbits/sec. and as many as four full-duplex voice connections. The Federal Communications Commission has proposed a channel-widening proposal to allow substantially higher bandwidth. For data security, SWAP specifies a robust but low-cost encryption algorithm that has never been broken. Security is required for all SWAP control points (see Network Topology), but it is optional for client devices such as cordless handsets and Web tablets.

Network Topology

HomeRF wireless networking supports both ad hoc networks and managed networks controlled by a connection point.

- An ad hoc network only supports data communication. All stations are equal, and control of the network is distributed between stations.
- A connection point is required for time-critical communications such as interactive voice. The connection point provides the gateway to the PSTN. It can be connected to a PC through an interface such as USB (Universal Serial Bus) that can support enhanced voice and data services. The connection point can also support power management, scheduling device wake-up and polling to help prolong battery life.

Since SWAP directly uses the IP address for device addressing one HomeRF network can theoretically support up to 2^{48} nodes. However companies shipping SWAP devices are recommending a practical limit of 10 devices These devices can be any mixture of the following four types:

- Connection point for voice and data services
- Voice terminal that uses TDMA only to communicate with a base station
- Data node that uses CSMA/CA to communicate with a base station and with other data nodes
- Voice and data node, which uses both TDMA and CSMA/CA services

Lower Cost

While availability, solid technical features, reliability, simplicity, and ease of use are all keys to the success of HomeRF wireless networking, one of the most important factors is low cost. SWAP provides TCP/IP support based on the IEEE 802.11 protocol, relaxing the PHY (physical layer) specification to lower radio cost, and eliminating some complex portions of the protocol to reduce costs even further. SWAP also implements the relatively low-cost voice support technology of the DECT standard, adapted to the 2.4-GHz band.

The reasoning employed by the HomeRF Working Group is that costs can be kept as low as possible by the use of high-volume components, and HomeRF radios use parts that have been shipping in volume for many years. DECT, for example, is a widely deployed standard in Europe with frequencies similar to those used for HomeRF. In addition, frequency-hopping radios use non-linear amps that are relatively simple and inexpensive. Further hardware component integration and the arrival of CMOS radio devices will help drive down price points even lower.

Summary

Unlike the Bluetooth wireless specification, which was originally designed for short-range cable replacement connections, and unlike wireless Ethernet, which was invented for business campuses and large public buildings, the HomeRF wireless networking standard, defined by the SWAP protocol, was designed from the ground up for home users.

SWAP provides a unique combination of performance, ease of use, and low cost, and it supports both voice and data. With the deployment of broadband continuing to gather momentum and the multi-PC home on the rise, SWAP will provide a cost-effective way to connect home broadband gateways to cordless handsets and simultaneously provide shared Internet services to multiple users.

At the same time, its ease of implementation and relatively low price point will continue to make HomeRF wireless networking the enabling technology for a new generation of connected computing and communications products.

More Info

For more information on adding HomeRF technology to your development projects or additional information on the HomeRF Working Group, visit their Web site.

Author Bio

Paul Pilat is a marketing manager for the Connected.Home Initiative in the Intel Architecture Labs. His responsibilities include identifying and developing intelligent connected home devices that enable consumers to enjoy enhanced broadband services. He is also actively involved with the marketing of HomeRF wireless networking technologies and is an active member of the HomeRF Working Group Compliance committee.

Paul joined Intel Corporation in 1999. He has more than 21 years of experience in the consumer electronics industry, including positions in production management and business development. He has extensive experience in bringing new consumer electronics products to market.

Paul holds a B.S. in mechanical engineering from the University of Massachusetts, Dartmouth. He is currently on the steering committee for the HomeRF Working Group and is a board member of the CEDIA Home Networking Council.

DTV Tools for Content Creation and Delivery

Patrick Wong
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Overview

With both digital television (DTV) and the Internet finding their way into more and more homes, content creators are discovering they have both audiences and technologies in common. However, the tasks they face in creating digital content and delivering it over broadband are as varied as the industries and disciplines they come from.

With Web and broadcast technologies converging, these professionals face the challenge of making content development and broadcast delivery a seamless process. Developers who can focus on the specific needs of the individual broadcaster, network administrator, and content creator can succeed in creating a suite of tools that support all these professionals. This article defines the key parts of the digital broadcast pipeline and describes the feature sets developers have to address in tool design.

Emergence and Convergence

The dramatic growth of the Internet will continue over the next several years. Digital broadcast is likewise growing and bringing more broadband capabilities to homes around the world. With both media proliferating, Web content producers and television professionals are discovering they share audiences as well as technologies. Through digital broadcast, dynamic Web-style content can accompany digital programming to create a personal, customizable, enhanced television experience for viewers.

The Advanced Television Enhancement Forum (ATVEF) has taken the first steps toward defining a standard with the Enhanced Content Specification for HTML-based enhanced television content. This specification lets content creators deliver enhanced programming over all forms of transport (analog airwaves, digital airwaves, cable, and satellite) to any ATVEF-compliant receiver. Digital broadcast is the most exciting medium simply because of the large “digital pipe” it uses to send not only video and audio but rich data content as well.

The need for ATVEF-compliant digital television (DTV) tools to simplify the process of combining video, audio, and Web-based data assets to deliver over digital broadcast is beginning to be recognized in the broadcast television and film production industries. However, the phrase “DTV tools” means different things to the different content developers working with the digital broadcast pipeline. Web-style content developers and television professionals need a WYSIWYG (what-you-see-is-what-you-get) tool to review their content. Broadcasters need tools to manage the entire digital broadcast system from scheduling to bandwidth management.

The best way to approach DTV tool design is to look at the key parts in the digital broadcast pipeline. By describing the tasks performed in each stage, developers can define feature sets that address the varying needs of each part of the digital broadcast process.

Tools Category

The tools digital broadcast professionals require fall into four categories:

- Content Creation
- Schedule/Insert, Transmit
- System Management
- Services Management

A simple interpretation of the content creation and delivery process, from content development to content broadcast, appears in Figure 1.

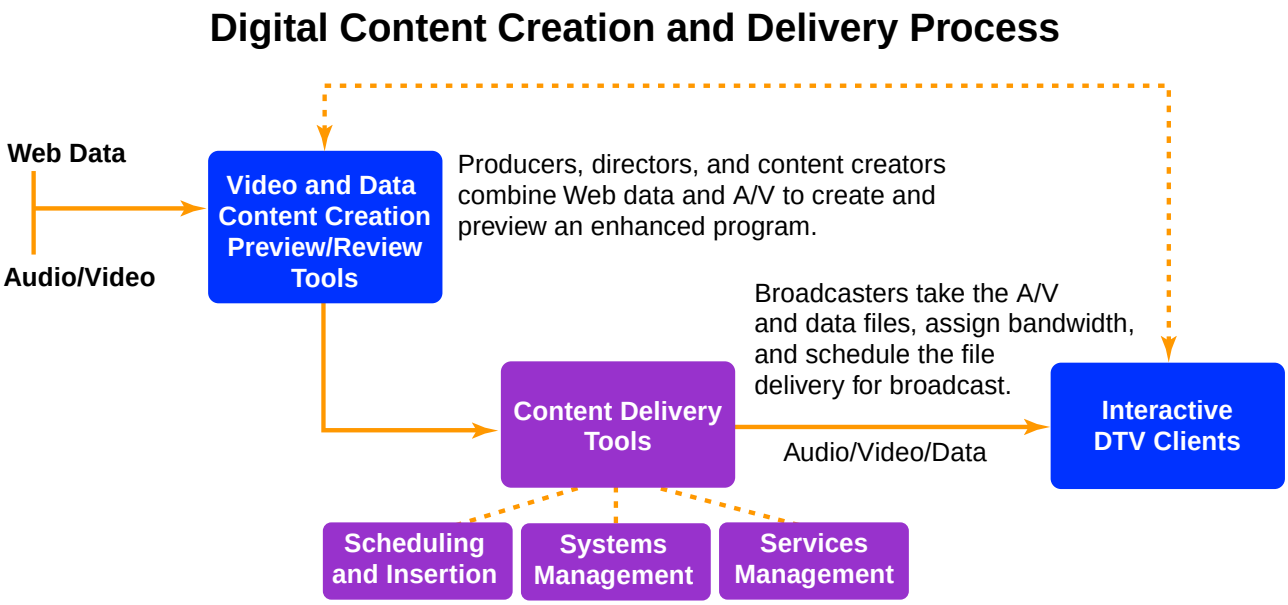

Figure 1

Content Creation

Today, many content developers for interactive DTV content hand-link data assets to pre-edited video content and manually ensure compliance with the ATVEF specification. This is a time-consuming and difficult process that doesn't always produce the desired end result.

Future Content Creation Tools for enhanced programming will let users easily synchronize audio, video, and data assets, simplifying the authoring process. These tools may also offer previewing and scheduling of content, enabling content producers and directors to validate and deliver the output to the broadcaster. Another key feature will be the ability to output programs in ATVEF, as well as other data formats for different standards and delivery pipes. Tools that are used to produce ATVEF-enhanced television programs will also be able to output the same programs in streaming Web formats.

Content Creation Tools features should include:

- WYSIWYG interface to simplify synchronization of assets
- Simulation of the program and the timing of data assets, which can be synchronized with time points within the broadcast or timed to appear after the program
- Automated output of ATVEF-compliant coding, other broadcast data standards, and streaming Web formats

Content creation tools are beginning to emerge in the market. At the recent National Association of Broadcasters 2000 Conference in Las Vegas, Avid Technology, Inc. demonstrated an early version of a new authoring tool for interactive digital television content. The tool is the result of their collaboration with Intel Corporation, Microsoft Corporation, and select broadcasters including PBS (the Public Broadcasting Service) and is currently code named Avid ITVauthor*. To find out more about the announcement, read the NAB press releases issued by Avid, by Intel, and by Microsoft.

The Avid ITVauthor tool:

- Lets video editors and Web content developers use one simple tool to integrate audio, video, HTML, and other content into comprehensive interactive programming
- Encodes in ATVEF format through a plug-in jointly created by the Intel Architecture Labs and Avid
- Supports multiple ATVEF-compliant set top clients such as PC-DTV and the Microsoft TV Platforms

Avid's ITVauthor

Figure 2

Other vendors that offer content creation tools for Enhanced TV:

- Blue Zone Entertainment, Inc.
- Mixed Signals Technologies
- RespondTV
- ViziWorx, Inc.
- Wink Communications

Schedule/Insert, Transmit

Scheduling and insertion tools serve as the backbone for enhanced data content delivery and are used in broadcast studios and production houses. Broadcasters can use the tools to synchronize the delivery of the data content with video. Scheduling and insertion tools encode data content in real time to accompany a live broadcast or pre-schedule carousel delivery of regular content. The tools then send the content to data encoders, which then insert the data into the broadcast alongside the program's audio and video streams.

Transmission tools determine whether the bandwidth required for delivering all the data assets within the program runtime is available. They also allow scheduling and management of extra bandwidth for more opportunistic data delivery. In addition, these tools ensure the right data goes to the right IP address.

Scheduling, insertion, and transmission tools features should:

- Schedule and deliver multiple data presentations, either related or unrelated to the program content, on multiple broadcast channels.
- Preview and validate programs before sending compiled content out to the broadcast stream.
- Allocate and monitor bandwidth usage and ensure that the preset bandwidth allocation for the specific program is honored.
- Perform IP management, ensuring the right data goes to the right IP address, running diagnostics to monitor resource allocations, and changing bandwidth allocations.

Here are examples where these tools can make a difference:

- A golf scoreboard is posted for 15 seconds in the video stream. Because digital video of a scoreboard takes very little bandwidth to send, data assets of each player's performance per hole can be updated during these 15 seconds.
- A content producer wants to send down something that's too large for the timeslot, and an alert pops up.
- One system wants data in English data; another wants it in Spanish.
- During prime time, air specific commercials and send down printable coupons.
- Near the end of a program, schedule and transmit statistical data relevant to the program.

An example of an Insertion and Transmission Tool is OPAL-IP over MPEG2 Broadcasting from Thomcast. The Home Products Group and Intel Architecture Labs at Intel are also developing tools for scheduling and insertion and transmission of data content.

System Management

System Management Tools maintain all the interactive DTV clients within a specified network. The idea of tools for managing a network of clients is not new. However, the idea of a digital set top device that can display digital video and interactive data *plus* play games and even provide a purchasing service (perhaps while watching a shopping-oriented program) all on one system is a new concept. It's clear that tools to maintain such an infrastructure are needed.

Maintaining interactive DTV clients also means updating software and firmware components on clients. System Management Tools features should:

- Update client with new software and firmware components.
- Update client with new peripheral software drivers if user plugs in a new peripheral.
- Send specific applications or game requested by user down to the client.
- Check the health of the client's configuration.
- Alert the service that the client needs assistance if the configuration is corrupt.
- Verify that the client is a legitimate product and that it is registered to the service provider.

For example, suppose the client needed an updated browser-based plug-in before new data assets from a new program were broadcast. The System Management Tools would update the corresponding clients that needed the newest version of the plug-in. Another example is if a user inserted a supported USB joystick into the system. The System Management Tools would deliver the correct joystick driver to the client, install the driver, and enable the system for multi-player gaming.

Services Management

Shopping-oriented shows with interactive content enable a viewer to make actual purchases on an interactive DTV client. This type of service requires tools to manage consumer transactions and update billing accounts.

To be effective, Services Management Tools will be able to manage billing of a new service, a new client subscription, or product purchase.

Using the USB joystick example again, here's how Services Management Tools would work for a multi-player gaming service. A user inserts a supported USB joystick in his client and the tool, recognizing a request for a configuration change, gives the user the option of enabling multi-player gaming on his system. If the user chooses to play, the service is immediately billed to his account.

Summary

The interactive DTV community is growing rapidly, and as more developers and broadcasters begin entering the interactive DTV market, more tools and better features will emerge. It is vital that the content development and content delivery industries understand each other's needs as they evolve to service the interactive DTV market. Among these needs is DTV tools.

As a tools developer, it is possible to create a tool suite to support more than one category of DTV tool user. Tools developers need to focus on specific features targeting the needs of a broadcaster, a network administrator, and the content creator separately in order to ensure the suite supports them all. With Web and broadcast technologies converging, it's important to understand the needs of each category of user in order to make content development and

broadcast delivery a seamless process.

Content creators, from producers and directors to Web content developers, need to take an active role in helping tools vendors understand the details involved in combining Web content with video content.

More Info

The Enhanced Content Specification 1.1 is available at the ATVEF Web site.

The Advanced Television Enhancement Forum Web site offers details about membership and upcoming events as well as technical white papers.

For details on topics discussed in this article, visit these online resources:

- "Tuning-in to Enhanced TV" from the November 1999 issue of Developer Update Magazine
- Intel's Digital Entertainment Initiative
- Intel's Press Announcement on "Data Enhancement Framework"
- Avid Press Announcement on "ITVauthor"
- The Avid Web site, which offers e-mail access [itv@avid.com] and more information about Avid ITVauthor
- Web sites of other content tool vendors mentioned in article: Blue Zone; Mixed Signal Technologies, Inc.; RespondTV; Viziworx, Inc.; Wink Communications, Inc.
- The Thomcast Web site, which offers information about the OPAL-IP over MPEG2 Broadcasting tool
- National Association of Broadcasters Web site
- Advanced Television Systems Committee Web site, which includes the ATSC Digital TV Standard

Author Bio

Patrick Wong works in the Tools/Technology Engineering organization in the Intel Architecture Content Group. His responsibilities include liaison with major video production tools developers including Avid, Media100, Inc., and Adobe Systems, Inc. Patrick also serves as the group's technical representative on interactive DTV and broadband technologies. Previously, Patrick worked on software optimizations of third-party digital video codecs for MMX™ technology and the recent Streaming SIMD Extensions to the Pentium® III processor architecture.

Software

Intel® IA-64 Porting Center

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Overview

One of the design goals of the Intel® Architecture family of 64-bit processors (IA-64) has been to support and enhance the operation of high-end applications on multiple operating systems. Major efforts are underway to enable IA-64 processor-based applications. These initiatives come not only from Intel but also from operating-system vendors, original-equipment manufacturers (OEM), and from independent software vendors (ISV).

In today's environment, most high-end applications involve porting to multiple operating-system platforms. Porting an application to a new processor architecture usually involves a number of issues: architecture, operating systems, software development tools, software conventions, run-time conventions, programming models, and hardware. To help address multiple-platform issues and ease porting, Intel and others participating in various IA-64 initiatives have made operating systems information, software development tools, and other vital material available online from the new Intel IA-64 Porting Center.

Whether you are beginning to port or are already porting your application to the IA-64 environment, information available now from the IA-64 Porting Center can help expedite your porting process. This information will help ensure that your products are available on IA-64 platforms when the Intel® Itanium™ processor-based platform is released to the market.

Intel IA-64 Porting Center

With the IA-64 Porting Center Intel offers developers a Web site filled with information on diverse topics related to porting applications to the IA-64 architecture. The site includes references to various Intel manuals, such as the “IA-64 Architecture Software Developer’s Manual” and the “IA-64 Software Conventions and Runtime Architecture Guide.” It also references documents that outline a step-by-step approach to porting an application to various operating systems. The site provides a link to information on Intel® Application Solution Centers. These centers, located throughout the world, provide training and assistance in porting applications to the IA-64 architecture. The Porting Center includes many pointers to self-paced, Web-based tutorials on topics such as “Migrating an existing application to IA-64 architecture.” The site also provides pointers to various assembly-language programming tools and other software development tools, such as the Intel® IA-64 compiler.

A number of porting-related technical papers are available on the site. Topics include migrating Windows* applications between Windows NT* and UNIX* platforms; OpenMP*C* and C++* application program interface (API); and OpenMP Fortran API.

Intel engineers involved in porting high-end applications have pooled their experience to make their collective knowledge available through the Porting Center. The site now includes relevant downloadable utilities and porting-related caveats. One such utility is a Korn shell script which partly automates conversion of an application that is already UNIX/64-safe to become Win32*/Win64*-safe. Another useful utility automates repetitive Win32-to-Win64 code cleaning using a tool based on pattern matching.

The Porting Center, like other sites mentioned in the More Info section of this article, is regularly updated. Check it frequently for recent additions and for updated information on various IA-64 porting-related topics.

Software Development Tools

Intel has produced a number of software development tools for IA-64. These software products include optimizing C/C++ and Fortran 95 compilers, an IA-64 assembler, a source-level debugger, and a version of Intel’s Vtune™ Performance Analyzer software. The tools are currently available as part of the IA-64 Software Development Kit (SDK).

Refer to the More Info section in this article for information on how to obtain a copy of the IA-64 SDK. The SDK products will be available as part of an expanded beta program scheduled to begin in Q2 of this year.

Evaluation copies of the IA-32 versions of these tools are available directly from the software area of the Intel Developer Web site. In addition, Intel has developed IA-64 optimized math library routines (libm) as well as an optimized version of the Math Kernel Library (MKL). The Intel developer's site currently offers libm in source form. The optimized MKL is scheduled to be released later in the second quarter (Q2). The optimized, source form of the MKL is available in the software area of the Intel Developer Web site.

The IA-64 Porting Center also offers information on various related tools from third parties. For example, the site references a technical white paper titled "Upgrading C/C++ Applications from Win32 to Win64." This paper has details about and several links to the MigraTEC* Migration Workbench*, which is available from MigraTEC, Inc. The MigraTEC Migration Workbench is divided into three main processes: inventory, analysis, and remediation. (The inventory process parses the source code, the analysis process identifies required code changes, and remediation makes the changes.)

Operating Systems

Intel is working closely with several operating system vendors to help port each operating system to the IA-64 architecture. Each of these initiatives is supported by several OEMs and ISVs. Additionally, each of these initiatives includes access to software development tools for the respective environments.

Windows 2000*—For detailed information on porting existing applications and/or developing new applications for 64-bit Windows, check the Windows 2000 area of the Microsoft Web site or Microsoft's library.

*Linux**—Known as the Trillian project, the porting of Linux to IA-64 is a significant initiative involving Intel and several other participants. The main Linux site for Trillian includes detailed information on Trillian, the status of the project, the sources that have gone open-source on kernel, and development tools.

Intel provides a site for all relevant sources that Intel has currently open-sourced, called Open Source from Intel. It provides documentation, application notes, and source code for libraries, tools, and code examples to the open-source community. You can also check the Linux site for open sources. Additionally, Intel and other distributors will soon be providing an IA-64 Linux development kit on CD. The development kit will help ISVs port and develop their IA-64 applications on an IA-32 host.

*Monterey**—Project Monterey is an initiative led by IBM and the Santa Cruz Operation, Inc. (SCO), with participation from Intel and others. Project Monterey is an initiative to deliver a high-volume enterprise-class UNIX. See the Project Monterey Web site for further information on the Monterey developer program.

A porting guide is available for download at IBM's Web site.

*HP-UX**—The Hewlett-Packard Company (HP) is working with several enterprise ISVs and customers that are porting and/or certifying their solutions for HP-UX on IA-64. Information on the HP cross-development environment for development of PA-RISC (the 64-bit HP architecture) with IA-64 is available from HP. Check the Hewlett-Packard Web site for developer resources, software, and technical papers.

*Modesto**—Novell, Inc. is working with Intel to create a new operating system called Modesto. For details about the Novell Modesto platform and development tools, visit the Novell Web site.

More Info

Information on training as well as other information useful to developers porting software applications is available on the Intel Developer Web site in the design, server, and software performance tools/training areas.

For information on an expanded Intel® beta program that includes the IA-64 SDK, send an e-mail message to compilers.beta@intel.com.

Summary
Technical information and software development tools are already available to help developers port their applications to IA-64 under multiple operating systems. This information is available not only from Intel, but also from other vendors and manufacturers in the industry. Server and workstation software vendors who begin porting to IA-64 now can make sure that Intel Itanium processor-native versions of their applications will be available early to their customers.

Author Bio
Kumar Balasubramanian has been with Intel for nine years, and is currently a software program manager in the Microcomputer Software Lab. He has focused on silicon design automation and software performance for next-generation Intel architecture platforms. Kumar has worked closely with ISVs to help optimize the performance of their software products and port their applications to the IA-64 architecture. He has received several Intel divisional recognition awards as well as a patent, and has several patent applications on file. Kumar holds an M.S. in computer engineering.

—End of Intel Developer Update Magazine Issue 9—